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Infrared Spectroscopy of Interplanetary Dust Particles

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Introduction: Dust plays a very important role in many processes in the Universe. E.g. it is of critical importance during the formation and the dieing of stars. Also in the interstellar medium its role as catalyst for several chemical processes is non negligible. Furthermore, dust can be used as a kind of history book for the space conditions the grain has experienced in the past. This all makes it very important to study extraterrestrial dust. The launch of the Infrared Space Observatory (ISO) opened a whole new wavelength range to study dust around other stars. For the first time we could get uninterrupted wavelength coverage form 2 to 200 micron. Many new infrared features have been found in the spectra of circumstellar dust both around young and old stars. Several of these spectral features have been identified, but also a large amount of them is still lacking proper identification, especially for wavelengths above 20 micron. Infrared spectroscopy of cosmic relevant dust will help us to identify more dust species. In this study we analyzed Interplanetary Dust Particles (IDP's) spectroscopically. IDP's are small (roughly 20 micron) extraterrestrial dust particles coming from our own Solar system, which are caught high in the atmosphere. These are the best examples we have of unaltered or only slightly altered cosmic material. We thin-sectioned these particles so that they could be studied in a Transmission Electron Microscope (TEM) for their chemical composition. We took infrared spectra of the same slices at the NSLS. This combination of infrared spectroscopy and characterization by TEM allowed us to couple astronomical relevant dust species with their infrared signature. It helps us to identify some of the unidentified features in our ISO spectra and thus to better understand the composition of circumstellar dust shells and the processes going on in these shells.

Results: Because of the limited wavelength range (only up to 25 micron) at the moment we could not yet fully exploit the possibilities of the NSLS. We could couple certain infrared features with minerals present in IDP's, however we already knew about the dust species responsible for these features. But it proves that our method works.

Conclusions: The method works but could benefit significantly from an increase in available wavelength range.

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